

EPA/OPP MICROBIOLOGY LABORATORY
ESC, Ft. Meade, MD

Standard Operating Procedure
for
Quality Assurance of Purified Water

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1.0 SCOPE AND APPLICATION:

- 1.1 This protocol outlines the measures that will be performed to verify that the quality of the de-ionized water used in the laboratory to make media and reagents and to dilute disinfectants during efficacy testing meets the water quality standards described in "Standard Methods for the Examination of Water and Wastewater", 19th ed., Table 9020:1. Quality of Purified Water Used in Microbiology Testing (see ref. 15.2).

2.0 DEFINITIONS:

- 2.1 ASTM = American Society for Testing and Materials. "Standard Methods", Table 1080:1. Reagent Water Specifications, provides a description of Type I through Type III water (see ref. 15.2).
- 2.2 Water Quality (or Water Suitability) Test is a test described in "Standard Methods" (see ref. 15.2) which is based on the growth of *Enterobacter aerogenes* in a specified medium, in the presence and absence of the test water. The Water Quality Test is designed to determine whether or not there are growth-inhibiting (e.g., toxic substances) or growth-promoting agents (e.g., nitrogen sources, carbon sources) in the test water. For acceptable water quality (i.e., no growth-inhibiting or growth-promoting agents), a ratio of *E. aerogenes* grown in the presence of the test water to *E. aerogenes* grown in the absence of the test water must be in the range of 0.8-3.0.

3.0 HEALTH AND SAFETY:

- 3.1 Several of the tests to be performed on the purified water require that the sample water be preserved with sulfuric or nitric acid. The testing laboratory (QC Laboratories, Southampton, PA) provides the ESC/OPP Microbiology Laboratory with water sample collection bottles already containing several milliliters of the appropriate acid. To protect against possible chemical burns, the laboratory worker must wear a lab coat, gloves, and protective eyewear (e.g., glasses or goggles) while filling water sample bottles containing sulfuric or nitric acid.

4.0 CAUTIONS:

- 4.1 Let the water run for approximately 30 seconds prior to filling sample

collection bottles.

- 4.2 The water collected for the heterotrophic plate counts must be analyzed by QC Laboratories within 30 hours of collection and must be kept cold during transit. Therefore, the water sample must be placed, along with one or more refrigerant packs, in a cardboard box-enclosed styrofoam shipping container (suggested by FedEx as a means for shipping items on wet ice or with refrigerant packs) to QC Laboratories via FedEx (see 10.0). The samples should be collected on the same day, and as close to the pickup time as practicable. For example, if FedEx typically picks up packages every day at 3:00 PM, collect the water sample at 2:00 PM and package it for shipment. Check the box on the FedEx airbill indicating that the package must arrive at QC Laboratories by the next business day morning, not the next business day afternoon.
- 4.3 To maintain evidence of chain of custody and to ensure that the testing laboratory performs the analyses requested by the ESC/OPP Microbiology Laboratory, the QC Laboratories Chain of Custody form and the QC Laboratories sample identification labels must be legibly completed (see 10.6, 10.7, and 16.0).
- 4.4 Ship water samples to QC Laboratories on Mondays, Tuesdays, and Wednesdays only to ensure that the samples arrive prior to a weekend. Do not ship if a holiday falls during the week.

5.0 INTERFERENCES:

- 5.1 When a new lot of DPD Powder Pillows is received, conduct the total chlorine residual test prior to using the DPD Powder Pillows to monitor the total chlorine residual of the laboratory's de-ionized water (see 10.21). The manual for the Hach Total Chlorine Test Kit (0-3.5 mg/L) indicates that for optimum test results, reagent accuracy of each new lot of reagent should be checked (i.e., DPD [salt of N,N-Diethyl-p-Phenylenediamine Potassium Iodide Sodium Phosphate, Dibasic] Total Chlorine Reagent Powder Pillows). If the DPD Powder Pillows do not demonstrate reagent accuracy, the total chlorine residual test may be jeopardized.

6.0 PERSONNEL QUALIFICATIONS:

- 6.1 Personnel are required to be knowledgeable of the procedures in this

SOP. Documentation of training and familiarization with this SOP can be found in the training file for each employee.

7.0 SPECIAL APPARATUS AND MATERIALS:

- 7.1 The Environmental Science Center's de-ionized water system is designed to produce water to conform to ASTM Type III quality water with a minimum resistivity of 4.0 megohm-cm at 25°C (see ref. 15.5). Domestic water is purified by treatment with the following: multi-media filters, water softeners, carbon filters, ultraviolet (UV) units, reverse-osmosis units, 5 µm filters, 0.45 µm filters, and mixed-bed de-ionizers. For further information on the Environmental Science Center's purified water system, contact the Facility Operation Branch Mechanical Engineer at (410) 305-2646.
- 7.2 The de-ionized water port on the north wall of room B206 is outfitted with a Barnstead B-pure Pressure Cartridge System. The Barnstead B-pure Pressure Cartridge System contains a Still Pretreatment cartridge and an Ultrapure cartridge which raise the quality of the de-ionized water to between ASTM Type III and ASTM Type II . Refer to the Barnstead B-pure Pressure Cartridge System Operation Manual and Parts List, Series 583 for operation and maintenance of the equipment and instructions on changing filters (see ref. 15.1).
- 7.3 Water sample collection bottles from QC Laboratories (may or may not be pre-labeled). Contact QC Laboratories at 215-355-3900 to obtain additional bottles.
- 7.4 QC Laboratories Chain of Custody forms(see 16.1). Contact QC Laboratories to obtain additional forms.
- 7.5 QC Laboratories sample identification labels (for non-pre-labeled bottles) (see 16.2). Contact QC Laboratories to obtain additional labels.
- 7.6 Cardboard box-enclosed styrofoam shipping container (e.g., Fisher catalog numbers 03-530-17 or 11-676-19)
- 7.7 Refrigerant packs
- 7.8 Plastic bags of approximately 2.5 to 3.0mil wall thickness

- 7.9 Hach Total Chlorine Test Kit, 0-3.5 mg/L (Hach catalog number 2231-03)
- 7.10 Isopropyl alcohol
- 7.11 Soft cloth (e.g., Texwipe TX409 absorbond wipers, VWR catalog number TWTX409)
- 7.12 Chlorine Standard Solution, 50-75 mg/L, 2-mL PourRite ampule (Hach catalog number 14268-20)
- 8.0 INSTRUMENT OR METHOD CALIBRATION: Not applicable
- 9.0 SAMPLE HANDLING AND STORAGE:
 - 9.1 Refer to section 4.0 for sample handling and storage conditions.
- 10.0 PROCEDURE AND ANALYSIS:
 - 10.1 The total residual chlorine of the laboratory's purified water is monitored on a monthly basis.
 - 10.1.1 Clean two beakers and the kit's plastic viewing tubes and caps with isopropyl alcohol or a non-abrasive detergent prior to commencing the test. Rinse several times with de-ionized water (from the Barnstead B-Pure filtration unit on the north wall of room B206). Use a soft cloth for wiping or drying the plastic viewing tubes. Do not use paper towels or tissue as this may scratch the plastic.
 - 10.1.2 In a beaker, collect approximately 100 mL sample water from the Barnstead B-Pure filtration unit on the north wall of room B206. Pour water from the beaker into one plastic viewing tube until the water level reaches the first line (bottom edge of the frosted area-equals 5 mL). This is the blank.
 - 10.1.3 Cap the blank and place it in the top left opening of the color comparator (containing color disc).
 - 10.1.4 Snap open an ampule of the Chlorine Standard Solution,

(50-75 mg/L, 2-mL PourRite ampule). Note the amount of free chlorine at the time that the ampules were filled. This value can be found on the first page of the instructions accompanying the chlorine standard.

- 10.1.5 Prepare a dilution of the standard to yield anywhere from 1 to 3 mg/L free chlorine. For example, if the amount of free chlorine in the standard is 64.2 mg/L, adding 1 mL of the chlorine standard to 49 mL water will yield a water sample with approximately 1.3 mg/L chlorine (calculation: $[64.2 \text{ mg/L}][1 \text{ mL}] = [X \text{ mg/L}][50 \text{ mL}]$; solving for X yields $X = 1.28 \text{ mg/L}$). Using a sterile 25 mL pipet, pipet 49 mL of water from the beaker and add it to a second, empty beaker. Using a sterile 1 mL pipet, add 1 mL of the chlorine standard to the 49 mL of water. Swirl to mix.
- 10.1.6 Fill the second plastic viewing tube to the first line (bottom edge of the frosted area) with chlorinated water from the second beaker.
- 10.1.7 Add the contents of one DPD Total Chlorine Reagent Powder Pillow to the second tube. To open the powder pillow, tap the bottom of the packet on a hard surface, tear open the packet along the dashed line, open the packet and form a spout by squeezing the side edges, and pour the contents into the sample.
- 10.1.8 Cap the second tube and swirl to mix. Accuracy of the test is not affected by undissolved powder.
- 10.1.9 Wait 3 minutes. The result of the test must be read within 6 minutes of the addition of the powder.
- 10.1.10 Place the second tube in the top right opening of the color comparator. Hold the comparator up to a light source such as a window or lamp. Look through the openings in the front of the comparator.
- 10.1.11 Rotate the color disc until the color matches in the two openings.

- 10.1.12 Read the mg/L total chlorine in the scale window. The mg/L total chlorine read from the color comparator must approximate the chlorine concentration (mg/L) in the prepared dilution in order for the reagents to be used in the total chlorine residual test.
- 10.1.13 Record the results in the DPD Reagent Accuracy Form (see 16.1).
- 10.1.14 Discard the remaining chlorine standard in the ampule by pouring it down the sink. Rinse the ampule with water and place it in a box for broken glass.
- 10.1.15 Rinse the viewing tubes several times with de-ionized water and allow to dry before putting them back in the kit.
- 10.1.16 Return the color disc to its plastic storage envelope.
- 10.2 Discard expired DPD Total Chlorine Reagent Powder Pillows. Do not use them in conjunction with the Hach Total Chlorine Test Kit to determine the total chlorine residual of the water.
- 10.3 The water used in the laboratory to make media and reagents and to dilute disinfectants during efficacy testing is taken from the Barnstead B-pure Pressure Cartridge System filtration unit on the north wall of room B206. Consequently, this is the source of the water collected for quality assurance testing (see 4.1).
- 10.4 The water is checked for total heavy metals, specific heavy metals (Cd, Pb, Ni, Zn, Cu, and Cr), ammonia and organic nitrogen (total Kjeldahl nitrogen), total organic carbon, conductivity, total chlorine residual, heterotrophic plate counts, and water quality/suitability. The frequency of testing and accepted limits of water quality are presented in the table below:

Test	Monitoring Frequency	
Heavy Metals, Total	Annually	≤ 0.1 mg/L

Heavy Metals, Single (Cd, Cr, Cu, Ni, Pb, and Zn)	Annually	< 0.05 mg/L
Total Kjeldahl Nitrogen	Monthly	< 0.1 mg/L
Total Organic Carbon	Monthly	< 1.0 mg/L
Conductivity	Continuously/ Monthly	>0.5 megohms resistance or < 2 umhos/cm at 25°C
Total Chlorine Residual	Monthly	0 mg/L*
Heterotrophic Plate Counts	Monthly	< 1000 CFU/ mL
Water Quality (or Water Suitability) Test	Annually	0.8 to 3.0 ratio

*As detected by Hach Total Chlorine Test Kit (0.0-3.5 mg/L)

- 10.4.1 The tests and monitoring frequencies are those specified in "Standard Methods", Table 9020:1 (see ref. 15.3), with the exception of the monitoring frequency of the conductivity.
- 10.4.2 "Standard Methods" recommends monitoring the conductivity of water continuously or with each use. The Barnstead B-pure Pressure Cartridge System filtration unit in room B206 has an in-line resistivity meter which continuously reads and displays the resistivity of the water. When using water for any purpose, the lab staff must monitor the resistivity meter, while the water is flowing, to ensure that the water demonstrates > 0.5 megohms resistance and must record the resistivity reading in the Purified Water Resistivity Record (see 16.8). If the resistivity falls below 0.5 megohms, see 14.0 for suggested corrective actions or inform the analyst currently responsible for verifying the quality of the de-ionized water. As an added measure, the laboratory will have QC Laboratories test the conductivity of water on a monthly basis.

- 10.4.3 All test parameters will be conducted at the monitoring frequency indicated in the table in Section 10.4. Additionally, tests will be required whenever the source of the water is changed, there is an upgrade, or there is a known failure of the building's de-ionized water system.
- 10.4.4 Individual test parameters will be tested more frequently than described in 10.4.3 if a problem with water quality is identified (see 11.0 and 14.0).
- 10.5 Monitoring of total heavy metals, specific heavy metals, total Kjeldahl nitrogen, total organic carbon, conductivity, heterotrophic plate counts, and water suitability is performed by QC Laboratories (1205 Industrial Blvd., Southampton, PA 18966-0514, 215-355-3900). Monitoring of total chlorine residual is performed on a monthly basis by the EPA/OPP Microbiology Laboratory (see 10.21).
- 10.5.1 QC Laboratories is certified by the State of Maryland Department of Health and Mental Hygiene Laboratories Administration as a State Certified Water Quality Laboratory. A copy of the certification certificate is on file in the Quality Assurance of Purified Water Record Book.
- 10.6 Each month, in preparation for sending water samples to QC Laboratories, legibly, in ink, complete the QC Laboratories Chain of Custody form using form 16.3 as a guide. Note the following items:
 - 10.6.1 Initially leave blank any field in which the time (military time) of collection is to be entered. Time fields will be completed as samples are collected/packaging process is nearing completion.
 - 10.6.2 The "Client/Acct. No." is USEPA and the "Address" is Environmental Science Center, 701 Mapes Road, Ft Meade, MD 20755-5350.
 - 10.6.3 Under the "Bill to/Report to" field, enter "US govt Visa card.
 - 10.6.4 In the "Verbal/fax data due:" box, enter a date approximately 14 days from the sample collection date.

- 10.6.5 In the "Hardcopy due:" box, enter a date approximately 21 days from the sample collection date.
- 10.6.6 In the "Report Format:" field, check the "Standard + QC " box.
- 10.6.7 In the "Comments" field, enter "Standard + QC report format."
- 10.7 Each month, in preparation for sending water samples to QC Laboratories, legibly complete the QC Laboratories sample identification labels using form 16.4 as a guide.
 - 10.7.1 Initially leave the time field blank. Time fields (military time) will be completed as samples are collected.
 - 10.7.2 If all of the bottles are pre-labeled upon arrival from QC Laboratories, a second label is not required. Use a water proof pen or marker when filling out the label if it is attached to the bottle.
- 10.8 The water collected for the heterotrophic plate counts must be sampled by QC Laboratories within 30 hours of collection and must be kept cold during transit. Because it is more efficient to send all monthly water samples to QC Laboratories in one box rather than to send the heterotrophic plate count sample collection bottle separately, all water samples must be received by QC Laboratories within 30 hours of collection. On the day of collection/shipment, collect the water samples as late in the day as possible while still allowing adequate time to package the samples in time for pickup by FedEx. For example, if FedEx typically picks up packages every day at 3:00 PM, collect the water sample at 2:00 PM and package it for shipment.
- 10.9 Collect the water for analysis from the Barnstead B-Pure filtration unit on the north wall of room B206 by filling the appropriate sample collection bottle as indicated in the table below:

Test	
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Heavy Metals, Total	One Pint/No Preservative
Heavy Metals, Single (Cd, Cr, Cu, Ni, Pb, and Zn)	One Pint/Nitric Acid
Total Kjeldahl Nitrogen	One Pint/Sulfuric Acid
Total Organic Carbon	One Pint/Sulfuric Acid
Conductivity	One Pint/No Preservative
Heterotrophic Plate Counts	Sterile Bottle/No Preservative
Water Quality (or Water Suitability Test)	Square, Glass Bottle/No Preservative

10.9.1 Several of the tests to be performed on the purified water require that the sample water be preserved with sulfuric or nitric acid. QC Laboratories provides the ESC/OPP Microbiology Laboratory with water sample collection bottles already containing several milliliters of the appropriate acid. To protect against possible chemical burns, the laboratory worker must wear a lab coat, gloves, and protective eyewear (e.g., glasses or goggles) while filling water sample bottles containing sulfuric or nitric acid.

10.10 As each individual sample collection bottle is filled, legibly write the collection time (in military time) on the appropriate QC Laboratories sample identification label and on the QC Laboratories Chain of Custody form under "Collection" in the "Lab Use Only" section of the form. After recording the collection time, affix the QC Laboratories sample identification label to the sample collection bottle, set the bottle aside, and move on to the next bottle until all of the sample collection bottles are filled and labeled.

10.10.1 After filling the heterotrophic plate count sample collection bottle and affixing the appropriate label, place the bottle in the refrigerator until all other bottles have been filled, labeled, and placed in the shipping container.

- 10.11 "Standard Methods" (see ref. 15.2) requires that water collected for the water suitability test be boiled for 2 minutes. After collection, place the glass bottle (loosely capped) on a hotplate and bring the water slowly to a boil over medium-high heat. Do not turn the hotplate dial to "high" as the rapid heating process may cause the glass bottle to break. After the water has boiled for 2 minutes, remove the bottle from the hotplate and let cool on the benchtop. Once cool, tighten the cap and package the bottle for shipment.
- 10.12 Once all sample collection bottles have been filled and the collection time recorded on the QC Laboratories sample identification labels and on the QC Laboratories Chain of Custody form, place the bottles (except the heterotrophic plate count sample collection bottle) in a cardboard box-enclosed styrofoam shipping container (suggested by FedEx as a means for shipping items on wet ice or with refrigerant packs). Remove the heterotrophic plate count sample collection bottle from the refrigerator, place it in a plastic bag with one to two ice packs, and tape or tie the bag closed. Place the bag in the shipping container.
- 10.13 Add packing material to the sample collection bottles to prevent the bottles from moving during shipment.
- 10.14 Complete the QC Laboratories Chain of Custody form and prepare for shipment.
- 10.14.1 Ensure that the form is signed and dated in the appropriate boxes under the "Field Parameters Analyzed By:" field. This field is located near the lower right hand corner of the form. Record the time (military time) in the appropriate box.
- 10.14.2 Ensure that the full legal signature of the sampler appears in the "RELINQUISHED BY SAMPLER" box (near lower left hand corner of form) and that the date of shipment (which is also the date of collection) is recorded in the adjacent "DATE" box. Record the current time (military time) in the adjacent "TIME" box.
- 10.14.3 Detach the gold "CLIENT/FIELD REPRESENTATIVE" carbon copy from the QC Laboratories Chain of Custody form and set aside.

- 10.14.4 Photocopy the QC Laboratories Chain of Custody form and set aside. The form is photocopied because the carbon may be too light to be easily readable.
- 10.14.5 Place the QC Laboratories Chain of Custody form in a plastic bag and tape or tie it closed. Place the bag in the shipping container and tape the container closed.
- 10.15 Obtain a FedEx airbill from one of the Environmental Science Center mailrooms and complete it using form 16.7 as a guide. Note the following item:
 - 10.15.1 In section 1, enter "laboratory's return address as Environmental Protection Agency, 701 Mapes Road, Ft. Meade, MD 20755-5350.
 - 10.15.2 In section 2, enter " Water Analysis" as the internal billing reference information.
 - 10.15.3 In section 3, enter QC Laboratories' address as QC Laboratories, 1205 Industrial Blvd., Southampton PA 18966-0514 and the phone number as 215-355-3900. Do not check either of the "HOLD" or "WEEKEND Delivery" boxes.
 - 10.15.4 In section 4a, check the "FedEx Priority Overnight" box
 - 10.15.5 In section 5, check the "Other Pkg." box.
 - 10.15.6 In section 6, check the "No" box.
 - 10.15.7 In section 7, check the "Sender" box and fill in the Fed Ex account number.
- 10.16 Place the airbill inside the airbill holder. Peel off the paper from the backside (larger, lower section of paper) of the airbill holder to reveal an adhesive surface. Attach the airbill holder to the top of the shipping container. Do not peel off the narrow, top strip of paper from the airbill . FedEx must be able to pull out the airbill from the airbill holder.
- 10.17 Enter the FedEx Tracking Number (located at the top of the airbill) on the

photocopy of the QC Laboratories Chain of Custody form.

- 10.18 Take the package to the Region III dock area for pickup by FedEx. The "Sender's Copy" of the airbill is retained by the Environmental Science Center receptionist for tracking/logging purposes. Obtain the "Sender's Copy" from the receptionist and photocopy it.
- 10.19 As an alternative to section 10.18, the analyst may take the package directly to a local FedEx office for mailing, provided that the analyst meets the package receipt deadline for FedEx Priority Overnight parcels. Obtain the "Sender's Copy" of the airbill from FedEx and place it in the Quality Assurance of Purified Water Record Book.
- 10.20 Place the gold carbon copy, the photocopy of the QC Laboratories Chain of Custody form, and the photocopy of the "Sender's Copy" of the airbill in the Quality Assurance of Purified Water Record Book .
- 10.21 Monitor the total chlorine residual of the water each month using the Hach Total Chlorine Test Kit, 0-3.5 mg/L (Hach catalog number 2231-03).
 - 10.21.1 Clean a beaker and the kit's plastic viewing tubes and caps with isopropyl alcohol or a non-abrasive detergent prior to commencing the test. Rinse several times with the sample de-ionized water (from the Barnstead B-Pure filtration unit on the north wall of room B206). Use a soft cloth for wiping or drying the plastic viewing tubes. Do not use paper towels or tissue as this may scratch the plastic.
 - 10.21.2 Collect sample water from the Barnstead B-Pure filtration unit on the north wall of room B206 in the beaker. Pour water from the beaker into one plastic viewing tube until the water level reaches the first line (bottom edge of the frosted area-equals 5 mL). This is the blank.
 - 10.21.3 Place the blank in the top left opening of the color comparator.
 - 10.21.4 Fill the second plastic viewing tube to the first line (bottom edge of the frosted area) with sample water from the beaker.

- 10.21.5 Add the contents of one DPD (salt of N,N-Diethyl-p-Phenylenediamine Potassium Iodide Sodium Phosphate, Dibasic) Total Chlorine Reagent Powder Pillow to the second tube. To open the powder pillow, tap the bottom of the packet on a hard surface, tear open the packet along the dashed line, open the packet and form a spout by squeezing the side edges, and pour the contents into the sample. (Note: Check reagent accuracy of each new lot of DPD Total Chlorine Reagent Powder Pillows. See 5.1.)
- 10.21.6 Cap the second tube and swirl to mix. Accuracy of the test is not affected by undissolved powder.
- 10.21.7 Wait 3 minutes. The result of the test must be read within 6 minutes of the addition of the powder.
- 10.21.8 Place the second tube in the top right opening of the color comparator. Hold the comparator up to a light source such as a window or lamp. Look through the openings in the front of the comparator.
- 10.21.9 Rotate the color disc until the color matches in the two openings.
- 10.21.10 Read the mg/L total chlorine in the scale window. Record the mg/L total chlorine on the Total Chlorine Residual of Purified Water form (see 16.2).
- 10.21.11 Rinse the viewing tubes several times with de-ionized water and allow to dry before putting them back in the kit.
- 10.21.12 Return the color disc to its plastic storage envelope.

11.0 DATA ANALYSIS/CALCULATIONS:

- 11.1 When the report of water sample analysis is received from QC Inc. (see 16.5 for a sample report), record the QC Laboratories testing results legibly and in indelible ink under the "Test Results" column of form 16.6, Quality Assurance of Purified Water Form. Compare the testing results with the "Accepted Limits". For each parameter, if the testing results for

that parameter fall within the accepted limits, indicate in form 16.6 that the water quality is acceptable. If the testing results for that parameter fall outside of the accepted limits, indicate that the water quality is not acceptable, and record the corrective action taken (see section 14.0).

- 11.2 Record the results of the total chlorine residual test in the Quality Assurance of Purified Water Form (see 16.6). Compare the testing results with the "Accepted Limits". If the testing results fall within the accepted limits, indicate in form 16.6 that the water quality is acceptable. If the testing results fall outside of the accepted limits, indicate that the water quality is not acceptable, and record the corrective action taken (see section 14.0).
- 11.3 The water quality is acceptable only if the results for all parameters fall within the accepted limits.

12.0 DATA MANAGEMENT/RECORDS MANAGEMENT:

- 12.1 The QC Laboratories report of water sample analysis must be placed in the Quality Assurance of Purified Water Record Book along with the photocopy and golden carbon copy of the QC Laboratories Chain of Custody form.
- 12.2 Data will be recorded promptly, legibly, and in indelible ink on the Total Chlorine Residual of Purified Water, the Accuracy of Total Chlorine Test Kit, and the Quality Assurance of Purified Water forms (see 16.0). The forms will be kept in the Quality Assurance of Purified Water Record Book.
- 12.3 The Record Book is kept in a locked file cabinet in the file room D217. Archived data is subject to OPP's official retention schedule contained in SOP ADM-03, Records and Archives.

13.0 QUALITY CONTROL:

- 13.1 The EPA/OPP MICROBIOLOGY LABORATORY conforms to 40 CFR Part 160, Good Laboratory Practices. Appropriate quality control measures are integrated into each SOP.

14.0 NONCONFORMANCE AND CORRECTIVE ACTION:

- 14.1 If the water quality, including residual chlorine, falls outside of acceptable limits, take corrective actions immediately and retest the water to demonstrate that the water quality parameter(s) that previously fell outside of acceptable limits is/are now within acceptable limits.
- 14.2 Disinfectant efficacy tests may have been performed between the time the water quality fell outside of acceptable limits (i.e., potentially one day after the date of the previous sampling for that test parameter) and the time that results of successful retesting are received. If the media and reagent controls associated with each test indicate that the media and reagents perform(ed) acceptably, the test data are considered valid.
- 14.3 Refer to the following table for examples of corrective measures to take if water quality parameters fall outside of the acceptable limits:

Parameter	Suggested Corrective Measures
Heavy Metals, Total	Replace the Still Pretreatment and Ultrapure cartridges in the B-pure Pressure Cartridge System. See ref. 15.1
Heavy Metals, Single (Cd, Cr, Cu, Ni, Pb, and Zn)	Replace the Still Pretreatment and Ultrapure cartridges in the B-pure Pressure Cartridge System. See ref. 15.1
Total Kjeldahl Nitrogen	Replace the Still Pretreatment and Ultrapure cartridges in the B-pure Pressure Cartridge System.
Total Organic Carbon	Replace the Still Pretreatment cartridge in the B-pure Pressure Cartridge System. See ref. 15.1
Conductivity/Resistivity	Replace the Ultrapure cartridge in the B-pure Pressure Cartridge System. See ref. 15.1
Heterotrophic Plate Counts	Replace the final filter in the B-pure Pressure Cartridge System. See ref. 15.1
Water Quality (or Water Suitability) Test	Replace the Still Pretreatment and Ultrapure cartridge in the B-pure Pressure Cartridge System. See ref. 15.1

14.4 If the corrective measures in 14.3 have been taken and retesting demonstrates that the water quality parameter(s) that previously fell outside of acceptable limits continue to fall outside of acceptable limits, taken one or more of the following courses of action:

14.4.1 Discuss the problem with the Facility Operation Branch Mechanical Engineer (410-305-2646). The problem may stem from the Environmental Science Center's de-ionized water system, which is the feedwater for the Barnstead B-pure Pressure Cartridge System filtration unit. Retest the water following any corrective measures taken by the Facility Operation Branch Mechanical Engineer.

14.4.2 Consult with Region III scientists to determine if they have

experienced a similar problem. Retest the water following any corrective measures taken.

- 14.4.3 Call QC Laboratories and seek advice from technical staff. Retest the water following any corrective measures taken.

15.0 REFERENCES:

- 15.1 Barnstead B-pure Pressure Cartridge System Operation Manual and Parts List, Series 583.
- 15.2 Eaton, A.D., Clesceri, L.S., Greenberg, A.E. eds. 1995. Standard Methods for the Examination of Water and Wastewater, 19th Edition. American Public Health Association, American Water Works Association, Water Environment Federation.
- 15.3 U.S. EPA Region III and OPPTS Environmental Science Center Specifications, Volume 2, November 7, 1996.

16.0 FORMS AND DATA SHEETS:

- 16.1 DPD Reagent Accuracy Form
- 16.2 Total Chlorine Residual of Purified Water Form
- 16.3 QC Laboratories Chain of Custody Form (Supplied by QC Laboratories)
- 16.4 QC Laboratories Sample Identification Label (Supplied by QC Laboratories)
- 16.5 QC Laboratories Final Report
- 16.6 Quality Assurance of Purified Water Form
- 16.7 FedEx Airbill
- 16.8 Purified Water Resistivity Record

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DPD Reagent Accuracy Form
OPP Microbiology Laboratory[illegible]

Total Chlorine Residual of Purified Water Form OPP Microbiology Laboratory


[illegible]

QC Laboratories Chain of Custody Form (Example) OPP Microbiology Laboratory

QC LABORATORIES				CHAIN OF CUSTODY				LAB USE ONLY				MATRIX CODES			
1205 Industrial Blvd. Southampton, PA 18966-0514 Phone: 215-351-3900 Fax: 215-355-7231				Page 1 of 1 (See signature in all offices) US govt Visa Card				Lab LIMS No: LAB USE ONLY: Aerobic/Anaerobic Vials # HCl Vials NaOH pH H ₂ O ₂ pH H ₂ SO ₄ pH NaOH pH Unpreserved HCl pH Temp control K ₂ Cr ₂ O ₇				DW: DRINKING WATER BW: BOTTLED WATER WW: WASTEWATER SD: SOIL SL: SLUDGE OL: OIL SOL: NON SOLID SOLID MI: MISCELLANEOUS X: OTHER			
Client/Host No. USEPA Address: Environmental Science, Inc. 701 N. 10th St. City/State/Zip: Harrisburg, PA 17101-5250 Phone/Fax: 717-635-2555/717-635-3094				OC Contract: Michael Cottrell PO No.				ANALYSIS REQUESTED: Heterotrophic Plate Counts Total Kjeldahl Nitrogen Total Organic Carbon Conductivity Heavy Metals Total Heavy Metals Single (Cd, Cr, Ni, Pb, Zn) Water Solubility Test				Field Parameters Analyzed By: Michael Cottrell Date: 10/17/00			
PROJECT: FIELD ID:				Date: 10/17/00 Time: 1305 Mile: 1308 Mile: 1310 Mile: 1311 Mile: 1312 Mile: 1314 Mile: 1316				Number of Containers: Date: 10/17/00 Time: 1305 Mile: 1308 Mile: 1310 Mile: 1311 Mile: 1312 Mile: 1314 Mile: 1316				Field Parameters Analyzed By: Michael Cottrell Date: 10/17/00			
SAMPLED BY: Name/Company Michael Cottrell USEPA				Date: 10/17/00 Time: 1305 Mile: 1308 Mile: 1310 Mile: 1311 Mile: 1312 Mile: 1314 Mile: 1316				Number of Containers: Date: 10/17/00 Time: 1305 Mile: 1308 Mile: 1310 Mile: 1311 Mile: 1312 Mile: 1314 Mile: 1316				Field Parameters Analyzed By: Michael Cottrell Date: 10/17/00			
PREVIOUSLY BY: 1. Michael Cottrell PREVIOUSLY BY: 2. Michael Cottrell PREVIOUSLY BY: 3. Michael Cottrell PREVIOUSLY BY: 4. Michael Cottrell PREVIOUSLY BY: 5. Michael Cottrell				RECEIVED BY: 1. Michael Cottrell RECEIVED BY: 2. Michael Cottrell RECEIVED BY: 3. Michael Cottrell RECEIVED BY: 4. Michael Cottrell RECEIVED BY: 5. Michael Cottrell				COMMENTS: Standard - QC report format Hazardous: yes/no				COMMENTS: Standard - QC report format Hazardous: yes/no			

For example to add completion, see reverse side.

QC Laboratories Sample Identification Label (Example)
OPP Microbiology Laboratory

 QC Laboratories		1205 Industrial Blvd. P.O. Box 514 Southampton, PA 18966-0514 215-355-3900		LAB ID NUMBER
<u>CLIENT</u>		<u>ACCOUNT NUMBER</u>		
USEPA-Michele Cottrill		W05057		
<u>SAMPLE IDENTIFICATION</u>				
Deionized Water				
<u>SAMPLED BY</u>	<u>DATE</u>	<u>TIME</u>		
m. Cottrill	10/17/00	1305		
<u>ANALYSIS</u>		<u>PRESERVATIVE</u>		
Heterotrophic Plate Counts		None		

QC Laboratories Final Report (Example)

OPP Microbiology Laboratory



10/18/00 01:08pm

MICHELE COTTRILL
U.S. ENVIRONMENTAL PROTECTION AGENCY
ENVIRONMENTAL SCIENCE CENTER
701 MAPES ROAD
FT. MEADE, MD 20755-5350

Regarding:

MICHELE COTTRILL
U.S. ENVIRONMENTAL PROTECTION AGENCY
ENVIRONMENTAL SCIENCE CENTER
701 MAPES ROAD
FT. MEADE, MD 20755-5350

Account No: W05057, U.S. ENVIRONMENTAL PROTECTION AGENCY
Project No: W05057, U.S. ENVIRONMENTAL PROTECTION AGENCY

P.O. No:
PWSID No:

Inv. No: 310225

Sample Number L687665-1	Sample Description DEIONIZED WATER 1546-1549 Received Temp: 60°F Iced (Y/N): Y	Sampl. Date/Time/Temp 08/23/00 03:49pm NA°F	Sampled by Customer Sampled	
Parameter	Method	Result	RLs	Test Date
CONDUCTIVITY	EPA 600 Method 120.1	0.926 umhos	0.100 umhos	08/31/00
KJELDAHL NITROGEN	EPA 600 Method 351.2	ND mg/l	1.00 mg/l	09/08/00
TOTAL ORGANIC CARBON	EPA 600 Method 415.1	ND mg/l	1.00 mg/l	09/21/00
STANDARD PLATE COUNT	STD Methods 18th Ed. 9215	NEG col./ml	1. col./ml	08/24/00

L687665-1:

1. A water supply is considered bacteriologically "SAFE" if no Coliform bacteria are detected. To be considered "SAFE" your report should indicate "NEG" for the Coliform Test. If your report indicates a positive result "POS" or a value of one (1) or greater then your supply is "UNSAFE FOR DRINKING" contact your local Health Dept. or QC for advice.

A result of "ND" indicates the concentration of the analyte tested was either not detected or below the RLs.

QC INC's laboratory certification numbers are: PADER 09-151; NJDEP 77166/77001/02015, additional states upon request.

Definitions: ND=not detected; NEG=negative; POS=positive; COL=colonies; RLs=laboratory reporting limits; L/A=laboratory accident; TNTC=too numerous to count

A result marked with "DRY" indicates that the result was calculated and reported on a dry weight basis.

Allen D. Schopbach, President

Quality Assurance of Purified Water Form
OPP Microbiology Laboratory

QUALITY ASSURANCE OF PURIFIED WATER FORM					
Month/Year			Initials		
Parameters	Accepted Limits	Test Results	Acceptable?		
			Yes	No	
Heavy Metals, Total	≤ 0.1 mg/L				
Heavy Metals, Single: Chromium	< 0.05 mg/L				
Copper	< 0.05 mg/L				
Nickel	< 0.05 mg/L				
Zinc	< 0.05 mg/L				
Cadmium	< 0.05 mg/L				
Lead	< 0.05 mg/L				
Total Kjeldahl Nitrogen	< 0.1 mg/L				
Total Organic Carbon	<1.0 mg/L				
Conductivity	> 0.5 megohms resistance or <2 umhos/cm at 25°C				
Total Chlorine Residual	0 mg/L*				
Heterotrophic Plate Counts	< 1000 CFU/mL				

*As detected by Hach Total Chlorine Test Kit (0.0-3.5 mg/L)

FedEx Airbill (Example)
OPP Microbiology Laboratory

[illegible]

Purified Water Resistivity Record

OPP Microbiology Laboratory

[illegible]